34-436 AU EX
M9036 XR 351,432 Reference
EXAMINER

(No Model.) 2 Sheets—Sheet 1.

J. W. FREE & J. O. BROWN.

MALT DRYING APPARATUS.

No. 351,432. Patented Oct. 26, 1886.

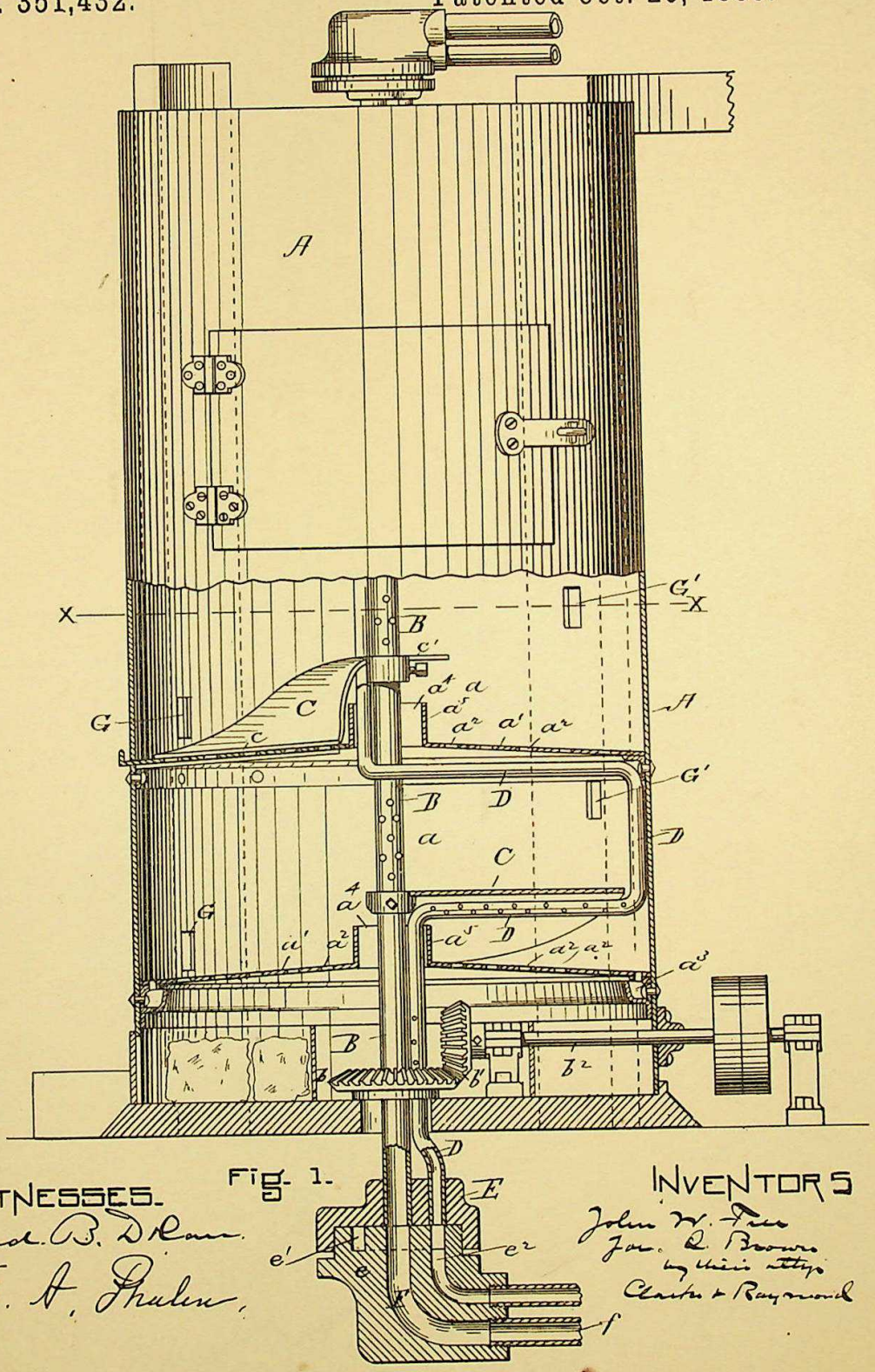

Fig. 1.

WITNESSES.
Fred. B. Dilcox.
E. A. Shulen.

INVENTORS
John W. Free
Jos. O. Brown
by their attys
Clarke & Raymond

N. PETERS, Photo-Lithographer, Washington, D. C.

Reference EXAMINER

(No Model.) 2 Sheets—Sheet 2.

J. W. FREE & J. O. BROWN.

MALT DRYING APPARATUS.

No. 351,432. Patented Oct. 26, 1886.

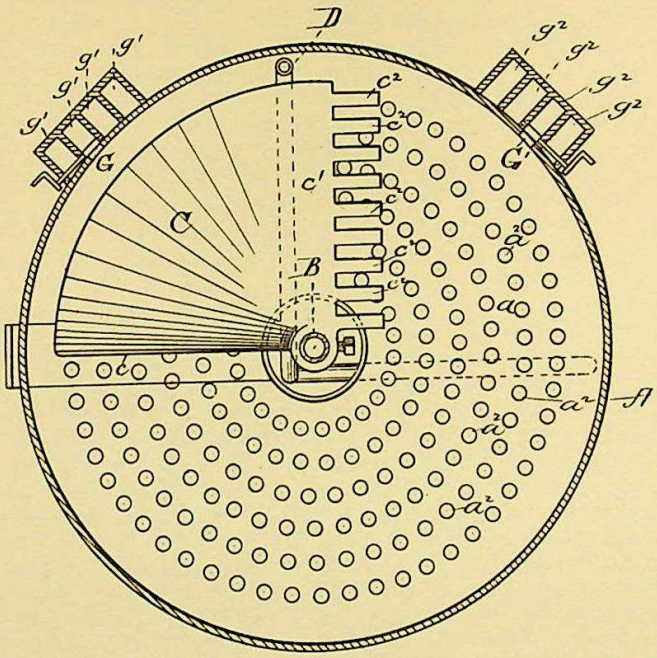

Fig. 2.

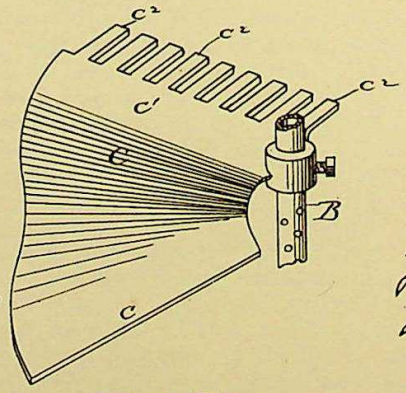

Fig. 3.

WITNESSES.
Fred. B. Dolan.
E. A. Phelan.

INVENTORS
John W. Free
Jno. O. Brown
by their attys
Charles E. Raymond.

N. PETERS, Photo-Lithographer, Washington, D. C.

34. DRYING & GAS OR VAPOR CONTACT WITH SOLIDS.

20

Cross Reference

EXAMINER

UNITED STATES PATENT OFFICE.

JOHN W. FREE AND JAMES O. BROWN, OF BOSTON, MASSACHUSETTS; SAID BROWN ASSIGNOR TO SAID FREE.

MALT-DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 351,432, dated October 26, 1886.

Application filed August 17, 1885. Serial No. 174,583. (No model.)

To all whom it may concern:

Be it known that we, JOHN W. FREE and JAMES OTIS BROWN, both of Boston, in the county of Suffolk and Commonwealth of Massachusetts, have invented a new and useful Improvement in Malt-Drying Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature, in which—

Figure 1 shows, part in front elevation and part in vertical section, a device or drier containing the features of our invention, and Fig. 2 is a horizontal section upon the line $x\ x$ of Fig. 1 and a plan of the parts below said line. Fig. 3 is a detail view showing the lifting and separating device.

The invention is an improvement upon that described in Letters Patent No. 316,353, dated April 21, 1885.

We employ in our present invention a casing, A, which is like that described in said Letters Patent, and it contains several chambers, a, separated from each other by horizontal partitions a', extending entirely across the same. As many of these chambers may be used as desired. The partitions are provided with the perforations a^2, and we prefer to make them of galvanized iron. There is arranged also about the outer edge of each of the partitions a channel or gutter, a^3, for conducting or carrying off the moisture or liquids which may escape from the malt. The partitions also have the centrally-located hole a^4 and the upward extension, a^5, about the same, and they are preferably crowned at the center somewhat—or, in other words, it is desirable that they should be little higher at the center and incline gradually and regularly therefrom to the outer edge. A vertical shaft, B, extends through the holes or openings a^4, and is adapted to be revolved by means of the beveled gear b and the beveled gear b' upon the counter-shaft b^2, and it has attached to it in each of the chambers a device for lifting the malt gradually from the surface of each partition and letting it fall slowly, in order that it may be separated into sufficiently small or minute bodies, and while thus separated subjected to the influence of steam or air passed through the chambers. This lifting and separating device comprises a thin plate, preferably of galvanized iron, although any other suitable material may be used, having a front edge, c, substantially parallel with the upper surface of the partition and arranged in close proximity thereto. The surface of this plate extends upward and backward from the edge c gradually to its back end, c', (see Fig. 2,) and there is arranged to project from this back end separators or teeth, c^2. The plate is fastened to the shaft B to be revolved thereby, and its operation is substantially as follows: The chamber being supplied with malt, the plate is slowly revolved therein, and the forward portion acts to lift or raise the malt or grains from the surface of the partition slowly and gradually, so that as the plate is revolved in the chamber or compartment all the malt is caused to be lifted from the partition by the passing of the plate under it, and as the plate passes from under it it drops from the end c' and from the fingers c^2 in a broken and separated condition. This device, it will be seen, subjects all the malt to a stirring action, and also in a manner to require the exertion of but comparatively little force or power upon the plate, as the action of the plate upon the malt is, in substance, that of a screw. While the malt is being submitted to this stirring action we prefer to introduce steam, or hot, cold, dry, or moist air, according to the necessities of the process; and we have arranged the supply-pipe D in relation to the elevators and separators so that a continuous supply of steam or air can be introduced into each apartment under the separator-plate and in close relation to the back edge thereof, so that the steam or air shall be forced through the malt while it is falling from the back edge of the separator. This pipe D is well shown in Figs. 1 and 2. In order to secure this result, it is of course necessary that this supply-pipe shall be revolved with the separators, and this involves a somewhat peculiar construction, and this is well shown in Fig. 1. It is also necessary that the separator-plate be made somewhat thin and arched, in order to provide a space beneath it into which the steam or air can enter from the supply-pipe, and from which it can be drawn by the exhaust through the grain as it falls over the back edge of the separator-plate.

The pipe D extends through the lower bear-

ing piece or block, E, which is perforated to receive it, and this bearing piece or block rests upon a support, *e*, which has the channel *e'* formed in its upper surface, into which the passage e^2, connected with the supply-pipe D, enters. The bearing-block E revolves with the shaft B, and the pipe D passes through the hole in the beveled gear *b* upward parallel with the shaft and through the central hole, a^4, in the partition, and then outward beneath the separating-plate, upward parallel with the casing, inward under the next partition above, upward through the hole a^4 therein, outward again under the next separating-plate; and as the bearing-block E revolves the entrance to the pipe is constantly over the channel or passage *e'* in the part *e*, so that the supply of steam or air is interrupted during its revolution. The pipe is provided with perforations for the delivery of steam or air in any part of the chamber desired; and we have represented in Fig. 1 the pipe as arranged to supply the steam or air beneath the separator-plates.

The shaft B may be hollow and be used for the purpose of introducing steam or air to the chambers, and in Fig. 1 we have represented it as so constructed, and as provided with perforations for the distribution of steam or air into the chambers. It receives the steam or air through the passage F, which is connected with the source of supply by the pipe *f*. Both the pipe D and hollow shaft extend through the top of the casing or apparatus, and instead of being used to inject steam or air into the apartments or chambers, they may be connected with devices for exhausting the air from the chambers, and when such devices are used they may be attached at the upper ends of these pipes, in order that the pipes may be used both ways, if desired—that is, to supply steam or air or exhaust-air as successive steps of the process of curing the malt.

In addition to the devices for introducing steam or air above described, we provide the casing with the inlet-openings G and outlet-openings G', for the purpose of obtaining, when desired, a circulation of air at atmospheric temperature through the same. The inlet-openings G, preferably, are arranged in the casing near the bottom of each chamber, and connecting the chamber with the cold-air ducts *g'*, which extend outside the casing, having a supply-opening at its lower end. The escape passages or openings G' are preferably arranged opposite the inlet-passages and near the top of each chamber, and they open into the escape-ducts g^2, which extend upward outside the casing and are open at their top. There may be arranged to be used in connection with these ducts either fan or exhaust blowers to increase the circulation.

For cooling the malt, ice may be placed in an ice-box in the lower chamber. (See Fig. 1.)

The malt is introduced into the various chambers through doors formed in the side of the casing, and in Fig. 1 we have represented one of these doors in elevation. The channels a^3, for receiving the drip or moisture, may be connected with each other by a vertical drip-escape pipe, not shown.

In operation, the malt, having first been subjected to proper treatment, is placed in the apartments *a*, upon the diaphragms or partitions, to the depth of several inches, and the shaft B is then caused to be revolved, and the lifting, stirring, and separating plates lift the malt in each chamber from its support and cause it to be broken or separated by lifting it up the inclined plane and dropping it continuously from the end of the plate, and the steam, moist, cool, or dry air is let in according as the grain may need treatment, and the circulation of air is increased or decreased according as circumstances may require. Of course the device may be used for drying any other kind of grain, whether previously treated or not. Each chamber, preferably, is supplied with a separate air supply and escape duct, and there is arranged in each duct a valve for controlling the supply of air. (See Fig. 2.) The perforations of the diaphragms or partitions are made so small that the grain cannot fall through the same. By providing them with perforations and a central opening, a^4, and shaping them, as described, it will be seen that provision is obtained for the continuous upward passage of heated air through the chambers.

Suitable doors will be provided to each chamber for charging and discharging the malt.

Having thus fully described our invention, we claim and desire to secure by Letters Patent of the United States—

1. The improved malt-drying apparatus containing, in combination, the casing divided into superimposed chambers by perforated diaphragms *a'*, pierced at the center, as shown at a^4, and having this central hole surrounded by the wall a^5, the said diaphragms *a'*, and their central walls, a^4, and the lifting and separating plate C for each chamber, having an edge parallel with the diaphragm or floor thereof, and rising gradually back from that line, then ending abruptly and forming a traveling air-space in front of the back edge thereof, through which air can be drawn or forced through the falling grain, in combination with an air-supply pipe or passage located beneath said plate, substantially as and for the purposes described.

2. The revolving share-shaped blade C, broad at its outer edge and nearly triangular in plan, its forward edge, *c*, and upper surface, *c'*, being in substantially parallel planes, and said upper surface, *c'*, being of a substantially rectangular form, and provided with backwardly-projecting teeth c^2, while the forward part of the blade, between the upper surface, *c'*, and the front edge, *c*, is of a slope lessening in steepness from center to circumference, whereby the malt is evenly distributed over the floor of the chamber when said share-shaped blade is revolved therein, and the entanglement of the rootlets broken up, substantially as described.

3. The combination, with a chamber, *a*, of the revolving stirring-plate *c*, and the revolving perforated pipe D, within said chamber and beneath the rear part of said plate C, substantially as described.

4. The combination, within a casing, A, of a series of superposed chambers, *a*, formed by diaphragms *a'*, inclined downward from center to circumference, and perforated as described, and each having the central wall, a^2, around a central hole, with a share-shaped blade, C, shaped as described, and a perforated pipe, D, arranged beneath the rear of said blade C in each of said chambers *a*, said blades C and pipes D being revolved within said casing A by the shaft B, substantially as described.

5. The combination of the shaft B, the pipe D, the bearing-piece E, having the hole e^2, and the annular channel *e'*, all substantially as described.

JOHN W. FREE.
JAS. O. BROWN.

In presence of—
F. F. RAYMOND, 2d.,
FRED. B. DOLAN.